CIRSA

PROVIDING RISK MANAGEMENT SOLUTIONS

December 7, 2015

Rod Tarullo, Director of Parks and Recreation
City of Golden
911 10th Street
Golden, CO 80401

Dear Rod:

In late 2014, I was given the task to investigate the potential airborne exposures to hazardous components of crumb rubber. This was prompted by a request made by Mike Bestor, former City Manager for the City of Golden. Since the beginning of 2015, I have been in contact with Chad Meinert of Golden to coordinate this air sampling. This report details the findings of air sampling for various hazardous components in styrene-butadiene-rubber (SBR) infill used in the majority of fields having synthetic grass. Recently, significant focus has been given to health hazards that crumb rubber may pose to patrons and employees using athletic fields. The majority of studies have focused on analyzing the components either in "raw" form or the leachate or run-off from water passing through and draining off such fields. Very few studies have been conducted on airborne exposures to patrons and employees. The studies that quote airborne concentrations have found chemicals that have not been extensively evaluated by NIOSH to develop an OSHA Permissible Exposure Limit (PEL) or NIOSH Recommended Exposure Limit (REL).

Attention has been given to known or potential carcinogens since exposure to even low concentrations of carcinogens over a long period could prompt the development of cancer. There are several potential routes of exposure, some with a higher potential than another. Soccer, football and rugby are the most common sports involving athletic fields with artificial turf and SBR (crumb rubber) infill. One of the sports that is most likely to have many years of exposure on such surfaces is soccer. Hence, airborne exposures were evaluated at the Rooney Road Sports complex with its soccer fields. Other potential routes of exposure are skin absorption, typically from falling on the soccer field surface, and ingestion by accidentally swallowing some of the crumb rubber. Air sampling was done prior to a soccer team that had a practice on the center field. There were also patrons that utilized remote controlled model planes and two with a parasail upon the center of the field. A review was done of current exposure studies on crumb rubber and a sampling scheme was developed to capture and analyze the chemicals quoted in such studies.

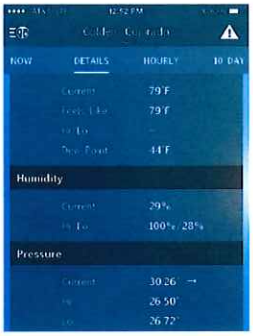
**Sampling and Investigation Methodology**

Air sampling was performed from approximately 9:44 AM to 3:40 PM utilizing four NIOSH methods appropriate for their capture and analysis. All sampling pumps were pre and post calibrated to determine air flow and volumes before and after each sample was placed on tubing used for the sampling train. The following NIOSH methods were used for sampling and analysis: (1) NIOSH 5528 SIM was used to collect sixteen of the most common and potentially hazardous polynuclear aromatic hydrocarbons (PAH). (2) NIOSH 7300 was used to sample for metals such as cadmium, lead and zinc and (3) NIOSH 5040 was used to sample carbon black. Sampling for highly volatile organic compounds (VOC) such as benzene, toluene and xylene was not performed since sampling at an indoor soccer field earlier this year did not reveal detectable levels of such VOCs.

Since the crumb rubber from such tires was installed several years ago, these low molecular weight petroleum distillates have largely off-gassed or volatilized into the air and are no longer present in large quantities in the crumb rubber. In order to find concentrations near the detection level, the maximum recommended air volume was collected to drive detection levels down. The remaining components; PAH, metals (specifically zinc), and carbon black are added for cohesiveness to bind the styrene butadiene rubber together and make it more resilient to wear and more absorbent of ultraviolet radiation from the sun. PAHs are not water soluble, yet fat soluble, and could pose a risk in skin absorption.

On August 28, 2015, I wore three sampling pumps with the sampling media for each method detailed above and walked the field from approximately 10:00 AM to 4:00 PM. Since there we virtually no patrons till 3:30 PM, I shuffled my shoes on the turf to simulate more active conditions. The temperatures above the field ranged from 76.2 to 85.9 degrees Fahrenheit. It was a mostly sunny day, with winds varying from northwesterly to southwesterly, averaging two to five miles per hour. There were also gusts from 15 to 17 mph during the sampling period. Humidity during the sampling period ranged from 29.2 to 39.9 % RH.

Temperatures were also measured on the turf using a Kestrel 4200 Pocket Air Flow Tracker. Turf temperatures varied from 97.4 to 108.7 degrees F. Cloud cover during the afternoon lowered the temperature radiating off the crumb rubber and Astroturf field. Since crumb rubber is between gray and black, it absorbs heat readily, and high temperatures and calm winds are considered worst case for chemicals that might off-gas from the crumb rubber. Such conditions existed for most of the day on August 28, 2015. There were also measurements of temperature, between six inches and one foot off of the turf, with the Kestrel meter. These temperatures close to, yet not on, the turf were between 87 and 91.1 degrees F. Most soccer practices and matches are played in the late afternoon and early evening when outside temperatures are lower.




**Air Sampling for Crumb Rubber Components**
**Three NIOSH Methods**

| Location of Sampling Conditions | Method No. Air Volume | Analyte/ Chemical | Concentrations of chemicals | Occupational Exposure Limit |
|---|---|---|---|---|
| John Colvin's breathing zone – mostly five feet off of the turf -76 to 86° | NIOSH **5528 SIM** 420.1 liters | **Naphthalene** The remaining 15 PAH analyzed were below the limit of detection | **0.000045 ppm** | **10 ppm *TWA** 15 ppm **STEL |
| John Colvin's breathing zone – mostly five feet off of the turf - 76 to 86° 29 – 40 % RH | NIOSH **7300** 1,248 liters | Cadmium<br>Lead<br>Zinc<br>12 other metals were analyzed as well | < 0.00011 mg/M$^3$<br>< 0.0019 mg/M$^3$<br>< 0.00012 mg/M$^3$ | 0.005 mg/M$^3$<br>0.05 mg/M$^3$<br>5 mg/M$^3$ |
| John Colvin's breathing zone – mostly five feet off of the turf - 76 to 86° average wind NW – SW 2-5 mph | NIOSH **5040** 764.7 liters | Organic Carbon<br>Elemental C<br>**Total Carbon** | 47 micrograms/M$^3$<br>< 1.7 micrograms/M$^3$<br>**47 micrograms/M$^3$** | 3.5 mg/M$^3$<br>or<br>**3,500 ug/M$^3$** |

(*) TWA – Time Weighted Average – The Permissible Exposure Limit is reported as an eight hour average (TWA) since most workdays are eight hours.
(**) STEL- Short Term Exposure Limit – This is a level that should not be exceeded during any fifteen minute period during the work day. STELs are often established for chemicals having an acute, as well as a chronic effect. Acute effects include eye, nasal and lung irritation as well as skin irritation.

In the sample results on the proceeding page, many of the chemical analytes listed were at a concentration below the limit of detection. The Polynuclear Aromatic Hydrocarbons (PAH) were all below the limit of detection with the exception of naphthalene. Naphthalene is considered by the World Health Organization and the International Agency for Research on Cancer (IARC) as a possible carcinogen to humans. Napthalene is made from crude oil or coal

tar and is the chief ingredient in moth balls. Most naphthalene will go from a solid state to a gas, with a half-life ranging from less than one day in the air to 80 days in the soil. As seen above, the measured concentration of naphthalene is orders of magnitude below what is permitted in the air, on average, over an eight hour period (0.000045 ppm versus 10 ppm). Hence, the OSHA permitted concentration is more than 200,000 times more than the measured concentration.

The metals analyzed using Method 7300 are shown in the analytical report from ALS Global. The metals cadmium, lead and zinc were of most interest due to their toxicity and prevalence, and hence are listed above. There were fifteen metals analyzed at the laboratory and listed in the report with "less than" values. Metals such as chromium and arsenic were also analyzed, yet these are not used or typically present in the manufacture of styrene-butadiene rubber used in tires.

Carbon black was measured utilizing NIOSH Method 5040 for air sampling and analysis. Airborne concentrations were well below the Occupational Exposure Limit of 3.5 $mg/M^3$ or 3,500 $ug/M^3$; (47 $ug/M^3$). There has been extensive research related to carbon nanotubes, otherwise known as nanoparticles. These particles are so small that they pass into the bloodstream when breathed, going through cell walls, and are a suspected carcinogen. These nanoparticles have been manufactured only recently to make products more strong and resilient, and little is known about the effects of long-term exposure to these agents. The airborne concentrations of carbon black on August 28, 2015 were more than ***74 times less*** than the occupational exposure limit. The skin exposure route to carbon black is probably limited considering the clothing worn by soccer players and limited time falling to the turf.

**Conclusions:**

1. The conditions on August 28, 2015 during air sampling involved above average temperatures and calm winds, highly conducive for off-gassing of petroleum distillates involved in the manufacture of tires. The crumb rubber at the Rooney Road Sports Complex is the product of grinding up vehicle tires. This crumb rubber is commonly used associated with artificial turf fields. The crumb rubber on the Rooney Road fields was between 1/8 to 3/16 inches in diameter.
2. The sample for taken for Polynuclear Aromatic Hydrocarbons (PAH) had only one PAH above the limit of detection; naphthalene. Naphthalene is a probable carcinogen listed by IARC. It has a TWA permissible exposure limit of 10 parts per million. The concentration found from six hours of air sampling revealed a concentration at least five magnitudes below what is permitted by OSHA.
3. Air sampling for metals revealed no metals above the limit of detection.
4. Carbon black exposures were at least ***74 times less*** than its corresponding occupational exposure limit. Its presence does indicate that particulate is lofted to the breathing zone height of the average person by disturbing the crumb rubber with foot traffic. Since air

sampling was done during a period of low activity on the fields, carbon black concentrations are likely to be greater during soccer practices and games.

**Recommendations:**

1. The concentrations found on the 28th of August, 2015 do not suggest that alternative infill materials need to be explored. However, there are specifications for greater quality infill materials that should be considered if the crumb rubber is to be replaced.

Please contact me if you have any questions regarding this report or a need for further sampling and evaluation. Thank you for the opportunity to have CIRSA serve your needs.

Sincerely,

John Wm. Colvin, CIH, CSP
Senior Loss Control Representative

CC: Bob Pomeroy, Senior Loss Control Representative

# ANALYTICAL REPORT

Report Date: September 15, 2015

John Colvin
CIRSA
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Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## Analytical Results

Sample ID: **GLD** Collected: 09/02/2015
Lab ID: 1524856001 Sampling Location: Golden & Castle Pine Received: 09/04/2015

**Method:** NIOSH 5528 SIM **Media:** SKC 226-58, Sorbent Tube, XAD-2 OVS, Quartz Filter **Analyzed:** 09/07/2015
**Sampling Parameter:** Air Volume 420.1 L

| Analyte | Result (ug/sample) | Result (mg/m³) | Result (ppm) | RL (ug/sample) |
|---|---|---|---|---|
| Naphthalene | **0.10** | **0.00024** | **0.000045** | 0.10 |
| Acenaphthylene | <0.10 | <0.00024 | <0.000038 | 0.10 |
| Acenaphthene | <0.10 | <0.00024 | <0.000038 | 0.10 |
| Fluorene | <0.10 | <0.00024 | <0.000035 | 0.10 |
| Phenanthrene | <0.10 | <0.00024 | <0.000033 | 0.10 |
| Anthracene | <0.10 | <0.00024 | <0.000033 | 0.10 |
| Fluoranthene | <0.10 | <0.00024 | <0.000029 | 0.10 |
| Pyrene | <0.10 | <0.00024 | <0.000029 | 0.10 |
| Benzo(a)anthracene | <0.10 | <0.00024 | <0.000025 | 0.10 |
| Chrysene | <0.10 | <0.00024 | <0.000025 | 0.10 |
| Benzo(b)fluoranthene | <0.10 | <0.00024 | <0.000023 | 0.10 |
| Benzo(k)fluoranthene | <0.10 | <0.00024 | <0.000023 | 0.10 |
| Benzo(a)pyrene | <0.10 | <0.00024 | <0.000023 | 0.10 |
| Indeno(1,2,3-cd)pyrene | <0.10 | <0.00024 | <0.000021 | 0.10 |
| Dibenzo(a,h)anthracene | <0.10 | <0.00024 | <0.000021 | 0.10 |
| Benzo(g,h,i)perylene | <0.10 | <0.00024 | <0.000021 | 0.10 |

Sample ID: **CP** Collected: 09/02/2015
Lab ID: 1524856002 Sampling Location: Golden & Castle Pine Received: 09/04/2015

**Method:** NIOSH 5528 SIM **Media:** SKC 226-58, Sorbent Tube, XAD-2 OVS, Quartz Filter **Analyzed:** 09/07/2015
**Sampling Parameter:** Air Volume 159.8 L

| Analyte | Result (ug/sample) | Result (mg/m³) | Result (ppm) | RL (ug/sample) |
|---|---|---|---|---|
| Naphthalene | <0.10 | <0.00063 | <0.00012 | 0.10 |

**Results Continued on Next Page**

# ANALYTICAL REPORT

Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## Analytical Results

Sample ID: **CP** — Collected: 09/02/2015
Lab ID: 1524856002 — Sampling Location: Golden & Castle Pine — Received: 09/04/2015
**Method:** NIOSH 5528 SIM — **Media:** SKC 226-58, Sorbent Tube, XAD-2 OVS, Quartz Filter — **Analyzed:** 09/07/2015
**Sampling Parameter:** Air Volume 159.8 L

| Analyte | Result (ug/sample) | Result (mg/m³) | Result (ppm) | RL (ug/sample) |
|---|---|---|---|---|
| Acenaphthylene | <0.10 | <0.00063 | <0.00010 | 0.10 |
| Acenaphthene | <0.10 | <0.00063 | <0.000099 | 0.10 |
| Fluorene | <0.10 | <0.00063 | <0.000092 | 0.10 |
| Phenanthrene | <0.10 | <0.00063 | <0.000086 | 0.10 |
| Anthracene | <0.10 | <0.00063 | <0.000086 | 0.10 |
| Fluoranthene | <0.10 | <0.00063 | <0.000076 | 0.10 |
| Pyrene | <0.10 | <0.00063 | <0.000076 | 0.10 |
| Benzo(a)anthracene | <0.10 | <0.00063 | <0.000067 | 0.10 |
| Chrysene | <0.10 | <0.00063 | <0.000067 | 0.10 |
| Benzo(b)fluoranthene | <0.10 | <0.00063 | <0.000061 | 0.10 |
| Benzo(k)fluoranthene | <0.10 | <0.00063 | <0.000061 | 0.10 |
| Benzo(a)pyrene | <0.10 | <0.00063 | <0.000061 | 0.10 |
| Indeno(1,2,3-cd)pyrene | <0.10 | <0.00063 | <0.000055 | 0.10 |
| Dibenzo(a,h)anthracene | <0.10 | <0.00063 | <0.000055 | 0.10 |
| Benzo(g,h,i)perylene | <0.10 | <0.00063 | <0.000055 | 0.10 |

Sample ID: **GLD-1** — Collected: 09/02/2015
Lab ID: 1524856003 — Sampling Location: Golden & Castle Pine — Received: 09/04/2015
**Method:** NIOSH 7300 Mod. — **Media:** MCE Filter — **Prepared:** 09/11/2015 — **Analyzed:** 09/13/2015
**Sampling Parameter:** Air Volume 1247.8 L

| Analyte | Result (ug/sample) | Result (mg/m³) | LOD (ug/sample) | RL (ug/sample) |
|---|---|---|---|---|
| Aluminum | <1.5 | <0.0012 | 1.5 | 5.0 |
| Arsenic | <0.75 | <0.00060 | 0.75 | 2.5 |
| Beryllium | <0.0038 | <0.0000030 | 0.0038 | 0.013 |
| Cadmium | <0.023 | <0.000018 | 0.023 | 0.075 |
| Calcium | <4.5 | <0.0036 | 4.5 | 15 |
| Chromium | <0.38 | <0.00030 | 0.38 | 1.3 |
| Copper | <0.15 | <0.00012 | 0.15 | 0.50 |
| Iron | <1.5 | <0.0012 | 1.5 | 5.0 |
| Lead | <0.38 | <0.00030 | 0.38 | 1.3 |
| Manganese | <0.038 | <0.000030 | 0.038 | 0.13 |
| Nickel | <0.038 | <0.000030 | 0.038 | 0.13 |
| Selenium | <0.75 | <0.00060 | 0.75 | 2.5 |
| Silver | <0.075 | <0.000060 | 0.075 | 0.25 |
| Sodium | <1.1 | <0.00090 | 1.1 | 3.8 |

**Results Continued on Next Page**

# ANALYTICAL REPORT

Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## Analytical Results

Sample ID: **GLD-1** Collected: 09/02/2015
Lab ID: 1524856003 Sampling Location: Golden & Castle Pine Received: 09/04/2015

**Method: NIOSH 7300 Mod.** **Media:** MCE Filter **Prepared:** 09/11/2015
**Sampling Parameter: Air Volume 1247.8 L** **Analyzed:** 09/13/2015

| Analyte | Result (ug/sample) | Result (mg/m³) | LOD (ug/sample) | RL (ug/sample) |
|---|---|---|---|---|
| Zinc | <0.15 | <0.00012 | 0.15 | 0.50 |

Sample ID: **CPAA** Collected: 09/02/2015
Lab ID: 1524856004 Sampling Location: Golden & Castle Pine Received: 09/04/2015

**Method: NIOSH 7300 Mod.** **Media:** MCE Filter **Prepared:** 09/11/2015
**Sampling Parameter: Air Volume 776.3 L** **Analyzed:** 09/13/2015

| Analyte | Result (ug/sample) | Result (mg/m³) | LOD (ug/sample) | RL (ug/sample) |
|---|---|---|---|---|
| Aluminum | <1.5 | <0.0019 | 1.5 | 5.0 |
| Arsenic | <0.75 | <0.00097 | 0.75 | 2.5 |
| Beryllium | <0.0038 | <0.0000048 | 0.0038 | 0.013 |
| Cadmium | <0.023 | <0.000029 | 0.023 | 0.075 |
| Calcium | **(4.7)** | **(0.0060)** | 4.5 | 15 |
| Chromium | <0.38 | <0.00048 | 0.38 | 1.3 |
| Copper | <0.15 | <0.00019 | 0.15 | 0.50 |
| Iron | <1.5 | <0.0019 | 1.5 | 5.0 |
| Lead | <0.38 | <0.00048 | 0.38 | 1.3 |
| Manganese | <0.038 | <0.000048 | 0.038 | 0.13 |
| Nickel | <0.038 | <0.000048 | 0.038 | 0.13 |
| Selenium | <0.75 | <0.00097 | 0.75 | 2.5 |
| Silver | <0.075 | <0.000097 | 0.075 | 0.25 |
| Sodium | <1.1 | <0.0014 | 1.1 | 3.8 |
| Zinc | <0.15 | <0.00019 | 0.15 | 0.50 |

Sample ID: **Lab Blank** Received: 09/04/2015
Lab ID: 1524856005 Sampling Location: Golden & Castle Pine

**Method: NIOSH 7300 Mod.** **Media:** MCE Filter **Prepared:** 09/11/2015
**Sampling Parameter: Air Volume Not Applicable** **Analyzed:** 09/13/2015

| Analyte | Result (ug/sample) | Result (mg/m³) | LOD (ug/sample) | RL (ug/sample) |
|---|---|---|---|---|
| Aluminum | **(2.0)** | NA | 1.5 | 5.0 |
| Arsenic | <0.75 | NA | 0.75 | 2.5 |
| Beryllium | <0.0038 | NA | 0.0038 | 0.013 |
| Cadmium | <0.023 | NA | 0.023 | 0.075 |
| Calcium | <4.5 | NA | 4.5 | 15 |
| Chromium | <0.38 | NA | 0.38 | 1.3 |
| Copper | <0.15 | NA | 0.15 | 0.50 |

**Results Continued on Next Page**

# ANALYTICAL REPORT

Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## Analytical Results

Sample ID: **Lab Blank** Received: 09/04/2015
Lab ID: 1524856005 Sampling Location: Golden & Castle Pine

**Method: NIOSH 7300 Mod.** **Media:** MCE Filter **Prepared:** 09/11/2015
**Sampling Parameter: Air Volume Not Applicable** **Analyzed:** 09/13/2015

| Analyte | Result (ug/sample) | Result (mg/m³) | LOD (ug/sample) | RL (ug/sample) |
|---|---|---|---|---|
| Iron | <1.5 | NA | 1.5 | 5.0 |
| Lead | <0.38 | NA | 0.38 | 1.3 |
| Manganese | <0.038 | NA | 0.038 | 0.13 |
| Nickel | <0.038 | NA | 0.038 | 0.13 |
| Selenium | <0.75 | NA | 0.75 | 2.5 |
| Silver | <0.075 | NA | 0.075 | 0.25 |
| Sodium | <1.1 | NA | 1.1 | 3.8 |
| Zinc | <0.15 | NA | 0.15 | 0.50 |

Sample ID: **GLD-1** Received: 09/04/2015
Lab ID: 1524856006 Sampling Location: Golden & Castle Pine

**Method: NIOSH 5040** **Media:** Quartz Fiber Filter **Analyzed:** 09/14/2015
**Sampling Parameter: Air Volume 1087.6 L**

| Analyte | Result (ug/sample) | Result (ug/m³) | RL (ug/sample) |
|---|---|---|---|
| Organic Carbon | **52** | **47** | 5.2 |
| Elemental Carbon | <1.8 | <1.7 | 1.8 |
| Total Carbon | **52** | **47** | |

Sample ID: **CPCB** Received: 09/04/2015
Lab ID: 1524856007 Sampling Location: Golden & Castle Pine

**Method: NIOSH 5040** **Media:** Quartz Fiber Filter **Analyzed:** 09/14/2015
**Sampling Parameter: Air Volume 664 L**

| Analyte | Result (ug/sample) | Result (ug/m³) | RL (ug/sample) |
|---|---|---|---|
| Organic Carbon | **27** | **40** | 5.2 |
| Elemental Carbon | <1.8 | <2.7 | 1.8 |
| Total Carbon | **27** | **40** | |

## Comments

**Quality Control: NIOSH 5040 - (HBN: 155776)**

QC's for this set are included in HBN 155720. All samples including QC's were run on 9/14/15.

**Quality Control: NIOSH 5528 SIM - (HBN: 155373)**

NIOSH 5528: This method has been validated for PAH compounds only. Additionally, studies regarding media collection efficiency, sample storage stability, analyte retention capability, and/or analyte desorption efficiency have been performed for PAH compounds only.

Dilution factor of 2 was taken into the calculation in the final report.

# ANALYTICAL REPORT

Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## Comments

**Quality Control: NIOSH 5528 SIM - (HBN: 155373)**

LCS/LCSD percent recoveries were slightly lower than the historical limits but within method control limits for Benzo(k)fluoranthene and Indeno(1,2,3-cd)pyrene. No corrective action was taken.

**Quality Control: NIOSH 7300 Mod. - (HBN: 155718)**

The zinc recoveries for MCE LCS 465402 and LCSD 465403 are high outside current LCS limits but within +/- 20% so the data is reported as is without further comment.

## Report Authorization (/S/ is an electronic signature that complies with 21 CFR Part 11)

| Method | Analyst | Peer Review |
|---|---|---|
| **NIOSH 5040** | /S/ Read A. Fritts<br>09/14/2015 15:09 | /S/ Thomas T. McKay<br>09/15/2015 13:09 |
| **NIOSH 5528 SIM** | /S/ Pooreun Lim<br>09/08/2015 11:09 | /S/ Thomas J. Masoian<br>09/08/2015 13:09 |
| **NIOSH 7300 Mod.** | /S/ Peter P. Steen<br>09/14/2015 09:09 | /S/ Lauren Jones<br>09/14/2015 11:09 |

## Laboratory Contact Information

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# ANALYTICAL REPORT

Workorder: **34-1524856**
Client Project ID: Golden and Castle Pines 090415
Purchase Order: NA
Project Manager: Rand Potter

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

## Definitions

LOD = Limit of Detection = MDL = Method Detection Limit, A statistical estimate of method/media/instrument sensitivity.
LOQ = Limit of Quantitation = RL = Reporting Limit, A verified value of method/media/instrument sensitivity.
ND = Not Detected, Testing result not detected above the LOD or LOQ.
NA = Not Applicable.
** No result could be reported, see sample comments for details.
< This testing result is less than the numerical value.
( ) This testing result is between the LOD and LOQ and has higher analytical uncertainty than values at or above the LOQ.